

## Crack Growth Behavior in the Threshold Region for High Cycle Fatigue Loading

The research results described in this paper presents a new understanding of the behavior of fatigue crack growth in the threshold region. It is believed by some crack growth experts that the ASTM load shedding test method does not produce true or valid threshold properties. The concern involves the observed fanning of threshold region  $da/dN$  data plots for some materials in which the low R-ratio data fans out or away from the high R-ratio data. This data fanning or elevation of threshold values is obviously caused by an increase in crack closure in the low R-ratio tested specimens. This increase in crack closure is assumed by some investigators to be caused by a plastic wake on the crack surfaces that was created during the load shedding test phase. This study shows that the increase in crack closure is the result of an extensive occurrence of crack bifurcation behavior in some materials, particularly in aluminum alloys, when the crack tip cyclic yield zone size becomes less than the grain size of the alloy. This behavior is related to the high stacking fault energy (SFE) property of aluminum alloys which results in easier slip characteristics. Therefore, the particular fanning behavior in aluminum alloys is a function of intrinsic dislocation property of the materials and that the fanned data represents valid material properties. However, for corrosion sensitive steel alloys used in this study the fanning was caused by a build-up of iron oxide at the crack tip from fretting corrosion.